Amendment to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Withdrawn) A process for making an epoxy resin comprising:

(a) converting a phenol or mixture of phenols to an aryl allyl ether of a phenol or mixture of phenols;

(b) converting the aryl allyl ether of a phenol or a mixture of phenols to an α-dihydroxy derivative of a phenol or mixture of phenols (i) in the presence of an oxidant or (ii) in the presence of an oxidant and a catalyst; and

(c) converting the α-dihydroxy derivative of a phenol or mixture of phenols to an aryl glycidyl ether epoxy resin of a phenol or mixture of phenols.

2. (Currently amended) The process of Claim [1] 44 wherein the phenol or mixture of phenols is represented by the structure of the following Formula VI:

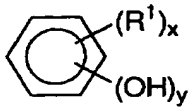
Formula VI

$$(R^1)_xAr(OH)_y$$

wherein Ar is an aromatic-containing moiety; $R^1$ is a group substituted for a hydrogen atom on the Ar moiety; OH is hydroxyl moiety; x is from 0 to 750; and y is from 1 to 150.

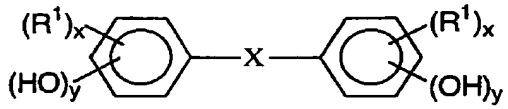
3. (Original) The process of Claim 2 wherein the phenol or mixture of phenols are one or more phenols represented by any one or more of the following Formulas VII-X:

Formula VII



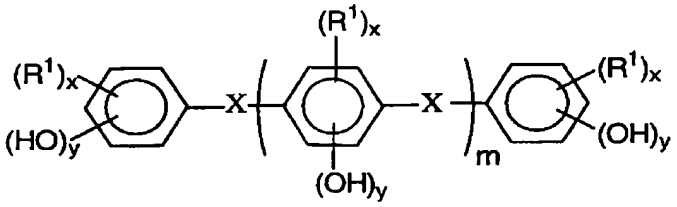
wherein $R^1$ is a group substituted for a hydrogen atom on the phenyl moiety; OH is hydroxyl moiety; x is from 0 to 5; and y is from 1 to 4;

Formula VIII



wherein $R^1$ is a group substituted for a hydrogen atom on the phenyl moiety; OH is hydroxyl moiety; X is nil, a heteroatom with or without substituents thereon to complete its necessary bonding valence, -C(O)-; -S(O2)-; -C(O)NH-; -P(O)Ar-; an organic aliphatic moiety, with or without heteroatoms, and -CR3=CH-, where $R^3$ is hydrogen or an alkyl group, a cycloaliphatic group or aromatic group; a cycloaliphatic group, with or without heteroatoms; or an aromatic group, with or without heteroatoms; or any combination thereof; partially or fully fluorinated; each x is from 0 to 4, and each x can be the same or different; and each y is from 1 to 4, and each y can be the same or different;

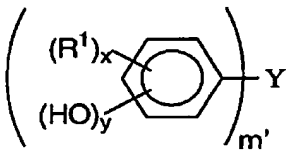
Formula IX



wherein $R^1$ is a group substituted for a hydrogen atom on the phenyl moiety; OH is hydroxyl moiety; X is nil, a heteroatom with or without substituents thereon to complete its necessary bonding valence, -C(O)-; -S(O2)-;

-C(O)NH-; -P(O)Ar-; an organic aliphatic moiety, with or without heteroatoms, and -CR3=CH-, where $R^3$ is hydrogen or an alkyl group, a cycloaliphatic group or aromatic group; a cycloaliphatic group, with or without heteroatoms; or an aromatic group, with or without heteroatoms; or any combination thereof; partially or fully fluorinated; x is from 0 to 4, and each x can be the same or different; each y is from 1 to 4, and each y can be the same or different; and m is from 0.001 to 10;

Formula X




wherein $R^1$ is a group substituted for a hydrogen atom on the phenyl moiety; OH is hydroxyl moiety; Y is an organic aliphatic moiety, with or without heteroatoms such as O, N, S, Si, B or P, or any combination of two or more of the above heteroatoms, wherein the aliphatic moiety has from 1 to 20 carbon atoms; a cycloaliphatic moiety, with or without heteroatoms, having from 3 to 20 carbon atoms; an aromatic moiety, with or without heteroatoms; or any combination thereof, with no more than about 20 carbon atoms; partially or fully fluorinated; an organosiloxane unit with the aryl groups attached to the Si atoms directly or through an organic aliphatic, cycloaliphatic, aromatic group, or any combination thereof, with no more than about 20 carbon atoms; each x is from 0 to 4, and each x can be the same or different; each y is from 1 to 4, and each y can be the same or different; and m' is generally 3 or 4.

4. (Original) The process of Claim 3 wherein at least one of the hydroxyl groups is attached to the aromatic group via a monoalkylene oxide or a polyalkylene oxide moiety.

5. (Original) The process of Claim 3 wherein the phenol or mixture of phenols is selected from the group consisting of 2-methylphenol; 4-methylphenol; 4-methoxyphenol; 2,6-dimethylphenol; 2,6-diisopropylphenol; 2,6-dibromophenol; 1,2-, 1,3- and 1,4-dihydroxybenzene; 1,4-, 1,5- and 2,6-dihydroxynaphthalene; 4,4'-

(3,3',5,5'-tetramethyl)bisphenol A; 4,4'-(3,3',5,5'-tetramethyl-2,2',6,6'-tetrabromo)bisphenol A; 4,4'-(3,3',5,5'-tetramethyl)bisphenol F; 4,4'-(3,3'5,5'-tetramethyl)biphenol; 4,4'-biphenol; 4,4'-(3,3'5,5'-tetramethyl-2,2',6,6'-tetrabromo)biphenol; 4,4'-bisphenol F; 4,4'-bisphenol sulfone; 2,2'-bis(3,5-dibromo-4-hydroxyphenyl)isopropylidene; 4,4'-bisphenol A; 4,4'-bisphenol K; 9,9-bis(4-hydroxyphenyl)fluorene; 4,4'-dihydroxy-α-methylstilbene; 1,3-bis(4-hydroxyphenyl)adamantane; phenol-formaldehyde novolac (functionality >2); o-cresol-formaldehyde novolac (functionality >2); phenol-dicyclopentadienyl novolac (functionality >2); naphthol-formaldehyde novolac (functionality >2); trisphenylol methane; tris(3,5-dimethyl-4-hydroxyphenyl)methane; 1,1,2,2-tetraphenylol ethane; or mixtures thereof.

6. (Withdrawn) A process for making an α-halohydrin intermediate of a phenol or mixture of phenols comprising the steps of:

(a) converting an aryl allyl ether of a phenol or mixture of phenols to an α-dihydroxy derivative of a phenol or mixture of phenols (i) in the presence of an oxidant or (ii) in the presence of an oxidant and a catalyst; and

(b) converting the α-dihydroxy derivative to an α-halohydrin intermediate of a phenol or mixture of phenols.

7. (Currently Amended) The process of Claim [6] 44 wherein the phenolic based α-halohydrin intermediate [of a phenol or mixture of phenols] is represented by the structure of the following Formula XXI:

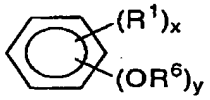
Formula XXI

$$(R^1)_x Ar(OR^6)_y$$

wherein Ar is an aromatic-containing moiety; $R^1$ is a group substituted for a hydrogen atom on the Ar moiety; $R^6$ is α-chlorohydrin propyl-containing moiety; x is from 0 to 750; and y is from 1 to 150.

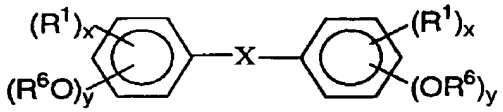
8. (Original) The process of Claim 7 wherein the α-halohydrin intermediate is one or more α-halohydrin intermdiates represented by any one or more of the following Formulas XXII-XXV.

Formula XXII



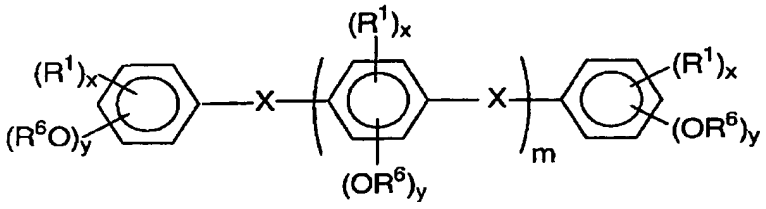
wherein $R^1$ is a group substituted for a hydrogen atom on the phenyl moiety; $R^6$ is an α-chlorohydrin propyl-containing moiety; x is from 0 to 5; and y is from 1 to 4;

Formula XXIII



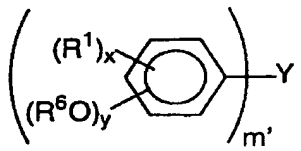
wherein $R^1$ is a group substituted for a hydrogen atom on the phenyl moiety; $R^6$ is an α-chlorohydrin propyl-containing moiety; X is nil, a heteroatom with or without substituents thereon to complete its necessary bonding valence, -C(O)-; -S(O2)-; -C(O)NH-; -P(O)Ar-; an organic aliphatic moiety, with or without heteroatoms, and -CR3=CH-, where R3 is hydrogen or an alkyl group, a cycloaliphatic group or aromatic group; a cycloaliphatic group, with or without heteroatoms; or an aromatic group, with or without heteroatoms; or any combination thereof; partially or fully fluorinated; each x is from 0 to 4, and each x can be the same or different; and each y is from 1 to 4, and each y can be the same or different;

Formula XXIV



wherein $R^1$ is a group substituted for a hydrogen atom on the phenyl moiety; $R^6$ is an α-chlorohydrin propyl-containing moiety; X is nil, a heteroatom with or without substituents thereon to complete its necessary bonding valence, -C(O)-; -S(O2)-; -C(O)NH-; -P(O)Ar-; an organic aliphatic moiety, with or without heteroatoms, and -CR3=CH-, where $R^3$ is hydrogen or an alkyl group, a cycloaliphatic group or aromatic group; a cycloaliphatic group, with or without heteroatoms; or an aromatic group, with or without heteroatoms; or any combination thereof; partially or fully fluorinated; x is from 0 to 4, and each x can be the same or different; each y is from 1 to 4, and each y can be the same or different; and m is from 0.001 to 10;

Formula XXV

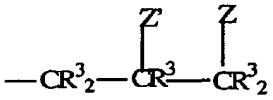


wherein $R^1$ is a group substituted for a hydrogen atom on the phenyl moiety; $R^6$ is an α-chlorohydrin propyl-containing moiety; Y is an organic aliphatic moiety, with or without heteroatoms such as O, N, S, Si, B or P, or any combination of two or more of the above heteroatoms, wherein the aliphatic moiety has from 1 to 20 carbon atoms; a cycloaliphatic moiety, with or without heteroatoms, having from 3 to 20 carbon atoms; an aromatic moiety, with or without heteroatoms; or any combination thereof, with no more than about 20 carbon atoms; partially or fully fluorinated; an organosiloxane unit with the aryl groups attached to the Si atoms directly or through an organic aliphatic, cycloaliphatic, aromatic group, or any combination thereof, with

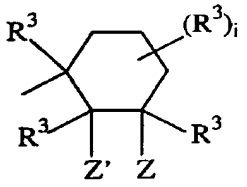
no more than about 20 carbon atoms; each x is from 0 to 4, and each x can be the same or different; each y is from 1 to 4, and each y can be the same or different; and m' is generally 3 or 4.

9. (Original) The process of Claim 8 wherein at least one $R^6$ is a monoalkylene oxide or a polyalkylene oxide terminated with a propenyl-containing moiety.

10. (Original) The process of Claim 8 wherein $R^6$ is a α-halohydrin propyl-containing moiety preferably selected from the group consisting of:



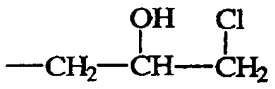
and



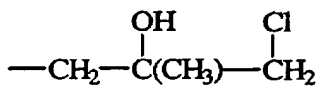
wherein Z is a halogen atom; Z' is a hydroxyl group; $R^3$ is the same or different in each occurrence and is hydrogen or an alkyl group, a cycloaliphatic group or aromatic group; and i is from 0 to 6.

11. (Original) The process of Claim 10 wherein the positions of the Z group and the Z' group may be interchanged.

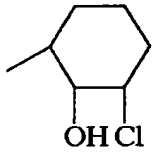
12. (Original) The process of Claim 10 wherein $R^6$ is selected from the group consisting of:



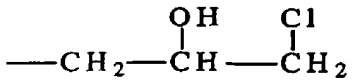
or



or



13. (Original) The process of Claim 12 wherein $R^6$ is



14. (Original) The process of Claim 8 wherein α-halohydrin intermediate is a chlorohydrin intermediate selected from the group consisting of (3-chloro-2-hydroxy-1-propyl) ether of 2-methylphenol; (3-chloro-2-hydroxy-1-propyl) ether of 4-methylphenol; (3-chloro-2-hydroxy-1-propyl) ether of 4-methoxyphenol; (3-chloro-2-hydroxy-1-propyl) ether of 2,6-dimethylphenol; (3-chloro-2-hydroxy-1-propyl) ether of 2,6-diisopropylphenol; (3-chloro-2-hydroxy-1-propyl) ether of 2,6-dibromophenol; bis(3-chloro-2-hydroxy-1-propyl) ether of 1,2-, 1,3- and 1,4-dihydroxybenzene; bis(3-chloro-2-hydroxy-1-propyl) ether of 1,4-, 1,5- and 2,6-dihydroxynaphthalene; bis(3-chloro-2-hydroxy-1-propyl) ether of 4,4'-(3,3',5,5'-tetramethyl)bisphenol A; bis(3-chloro-2-hydroxy-1-propyl) ether of 4,4'-(3,3',5,5'-tetramethyl-2,2',6,6'-tetrabromo)bisphenol A; bis(3-chloro-2-hydroxy-1-propyl)ether of 4,4'-(3,3',5,5'-tetramethyl)bisphenol F; bis(3-chloro-2-hydroxy-1-propyl) ether of 4,4'-(3,3'5,5'-tetramethyl)biphenol; bis(3-chloro-2-hydroxy-1-propyl) ether of 4,4'-biphenol; bis(3-chloro-2-hydroxy-1-propyl) ether of 4,4'-(3,3'5,5'-tetramethyl-2,2',6,6'-tetrabromo)biphenol; bis(3-chloro-2-hydroxy-1-propyl) ether of 4,4'-bisphenol F; bis(3-chloro-2-hydroxy-1-propyl) ether of 4,4'-bisphenol sulfone; bis(3-chloro-2-hydroxy-1-propyl) ether of 2,2'-bis(3,5-dibromo-4-hydroxyphenyl)isopropylidene; bis(3-chloro-2-hydroxy-1-propyl) ether of 4,4'-bisphenol A; bis(3-chloro-2-hydroxy-1-propyl)ether of 4,4'-bisphenol K; bis(3-chloro-2-hydroxy-1-propyl) ether of 9,9-bis(4-hydroxyphenyl)fluorene; bis(3-chloro-2-hydroxy-1-propyl) ether of 4,4'-dihydroxy-α-methylstilbene; bis(3-chloro-2-hydroxy-1-propyl) ether of 1,3-bis(4-hydroxyphenyl)adamantane; (3-chloro-2-hydroxy-1-propyl) ether of phenol-formaldehyde novolac (functionality >2); (3-chloro-2-hydroxy-1-propyl) ether of o-cresol-formaldehyde novolac (functionality >2); (3-chloro-2-hydroxy-1-propyl) ether of phenol-dicyclopentadienyl novolac (functionality >2); (3-chloro-2-hydroxy-1-propyl)ether of naphthol-formaldehyde novolac (functionality >2); tri(3-chloro-2-hydroxy-1-propyl) ether of trisphenylol methane; tri(3-chloro-2-hydroxy-1-propyl) ether of tris(3,5-dimethyl-4-hydroxyphenyl)methane; tetra-(3-chloro-2-hydroxy-1-propyl) ether of 1,1,2,2-tetraphenylol ethane; or mixtures thereof.

15. (Original) The process of Claim 14 wherein at least one of the 3-chloro-2-hydroxy-1-propyl moieties, the chlorine atom and the hydroxy group of the

α-chlorohydrin intermediate are interchanged to form a 2-chloro-3-hydroxy-1-propyl moiety.

16. (Withdrawn) The process of Claim 6 wherein step (b) comprises:

(i) reacting the α-dihydroxy derivative with a hydrogen halide in the presence of a carboxylic acid to form a phenolic-based α-halohydrin intermediate; or

(ii) reacting the α-dihydroxy derivative with a hydrogen halide in the presence of a carboxylic acid ester to form a phenolic-based α-halohydrin intermediate.

17. (Currently Amended) The process of Claim [16] 44 in which the amount of hydrogen halide used is from about 0.5 to about 20 equivalents of hydrogen halide relative to the equivalents of α-dihydroxy moieties being reacted.

18. (Currently Amended) The process of Claim [16] 44 in which the hydrogen halide is hydrogen chloride.

19. (Currently Amended) The process of Claim [16] 44 wherein the carboxylic acid used in [(i)] (c) is from about 0.05 mole % to about 50 mole % of carboxylic acid relative to the moles of α-dihydroxy derivative being reacted.

20. (Currently Amended) The process of Claim [16] 44 wherein the carboxylic acid used in [(i)] (c) is monocarboxylic acid or dicarboxylic acid having from 1 to 20 carbon atoms; or a multifunctional carboxylic acid wherein the carboxylic acid groups are attached to an inorganic, an organic, or a hybrid inorganic-organic support.

21. (Original) The process of Claim 20 wherein the carboxylic acid is selected from the group consisting of acetic acid, propionic acid, propenoic acid, 2-methylpropenoic acid, butanoic acid, 1,4-butanedioic acid, hexanoic acid, 1,6-hexanedioic acid, cyclohexanoic acid, 1,2-cyclohexandioic acid, benzoic acid, or mixtures thereof.

22. (Original) The process of Claim 21 wherein the carboxylic acid is acetic acid.

23. (Currently Amended) The process of Claim [16] 44 wherein a carboxylic acid ester is used in [(ii)] (c) to convert the α-dihydroxy derivative to the α-halohydrin intermediate.

24. (Original) The process of Claim 23 wherein the carboxylic acid ester used is from about 0.05 mole % to about 50 mole % of carboxylic acid ester relative to the moles of α-dihydroxy derivative being reacted.

25. (Currently Amended) The process of Claim [16] 44 wherein the carboxylic acid ester is used as a solvent in [(ii)] (c) to convert the α-dihydroxy derivative to the α-halohydrin intermediate.

26. (Original) The process of Claim 25 wherein the amount of carboxylic acid ester used as solvent is from about 0.25 to about 100 parts (on a weight basis) of carboxylic acid ester to 1 part α-dihydroxy derivative.

27. (Currently Amended) The process of Claim [16] 44 wherein the carboxylic acid ester is the ester of a monocarboxylic acid or dicarboxylic acid having 1 to 20 carbon atoms.

28. (Original) The process of Claim 27 wherein the monocarboxylic acid or dicarboxylic acid may contain one or more heteroatoms selected from the group consisting of O, N, S, Si, B, P, Cl or F.

29. (Original) The process of Claim 27 wherein the monocarboxylic acid or dicarboxylic acid of the carboxylic acid ester is selected from the group consisting of acetic acid, propionic acid, propenoic acid, 2-methylpropenoic acid, butanoic acid, 1,4-butanedioic acid, hexanoic acid, 1,6-hexanedioic acid, cyclohexanoic acid, 1,2-cyclohexandioic acid, benzoic acid, or mixtures thereof.

30. (Currently Amended) The process of Claim [16] 44 wherein the carboxylic acid ester is the ester of an aliphatic mono alcohol, diol, or triol having 1 to 12 carbon atoms.

31. (Original) The process of Claim 30 wherein the hydroxyl group(s) of the aliphatic mono alcohol, diol, or triol is a primary or secondary hydroxyl group.

32. (Original) The process of Claim 30 wherein the aliphatic mono alcohol, diol, or triol may contain one or more heteroatoms selected from the group consisting of O, N, S, Si, B, P, Cl or F.

33. (Original) The process of Claim 31 wherein the aliphatic mono alcohol, diol, or triol is selected from the group consisting of methanol, ethanol, propanol, isopropanol, 1-butanol, 2-butanol, isobutanol, cyclohexanol, benzyl alcohol, 1-methoxy-2-propanol, 1-ethoxy-2-propanol, ethylene glycol, diethylene glycol, propylene glycol, diproplene glycol, glycerine, trimethylolpropane or mixtures thereof.

34. (Currently Amended) The process of Claim [16] 44 wherein the carboxylic acid ester is selected from the group consisting of ethyl acetate, propyl acetate, isopropyl acetate, 1-methoxy-2-propanol acetate, butyl acetate, ethylene glycol diacetate, propylene glycol diacetate, trimethylolpropane triacetate or mixtures thereof.

35. (Currently Amended) The process of Claim [16] 44 using at least one or more optional solvents.

36. (Original) The process of Claim 35 wherein the at least one or more optionally used solvents are selected from the group consisting of aliphatic and cyclic hydrocarbons; aromatic hydrocarbons; chlorinated solvents; aprotic solvents; protic solvents; partially or fully fluorinated derivatives thereof; or any combination thereof.

37. (Original) The process of Claim 36 wherein the protic alcohol solvents optionally used are secondary or tertiary alcoholic solvents.

38. (Original) The process of Claim 36 wherein the at least one or more optionally used solvents are selected from the group consisting of pentane, hexane, octane, iso-octane, cyclohexane, cyclooctane, benzene, toluene, methylene dichloride, tetrachloroethane, chlorobenzene, acetone, methyl iso-butyl ketone, acetonitrile, dimethoxyethane, 2,2'-dimethoxy diethyl ether, dioxane, dimethyl sulfoxide, 1-methoxy-2-acetoxypropane, isopropyl alcohol, 2-butanol, tert-butanol, tert-amyl alcohol, cyclohexanol, and 1-methoxy-2-hydroxypropane; partially or fully fluorinated derivatives thereof; or any combination thereof.

39. (Original) The process of Claim 35 wherein the at least one or more optionally used solvents may be used with or without the presence of water.

40. (Original) The process of Claim 35 wherein the amount of at least one or more optionally used solvents is from zero to about 50 parts (on a weight basis) of a single solvent or a mixture of two or more solvents to 1 part α-dihydroxy derivative.

41. (Original) The process of Claim 25 including an amount of carboxylic acid ester used as solvent, and an amount of at least one or more optionally used second solvents such that the carboxylic acid ester is present in an amount that is greater than 25 mole % relative to the amount of α-dihydroxy derivative.

42. (Currently Amended) The process of Claim [16] 44 wherein step (c) is carried out at a [the] temperature [is] of from about 0 °C to about 150 °C.

43. (Currently Amended) The process of Claim [16] 44 wherein step (c) is carried out at a [the] pressure [is] of atmospheric, subatmospheric or superatmospheric.

44. (Currently Amended) A process for making an epoxy resin comprising the steps of:

(a) preparing an aryl allyl ether of a phenol or mixture of phenols by reacting (i) a phenol or a mixture of phenols with (ii) an allylation agent;

(b) converting an aryl allyl ether of a phenol or mixture of phenols to an α-dihydroxy derivative of a phenol or mixture of phenols (i) in the presence of an oxidant or (ii) in the presence of an oxidant and a catalyst;

(c) reacting the α-dihydroxy derivative prepared in step (b) with (i) a hydrogen halide and (ii) a carboxylic acid or carboxylic acid ester to form a phenolic-based α-halohydrin intermediate; and

(d) converting the phenolic-based α-halohydrin intermediate prepared in step (c) to an aryl glycidyl ether of a phenol or mixture of phenols as an epoxy compound or resin.

45. (Withdrawn) A product made by the process of Claim 1, Claim 16 or Claim 44.

46. (Cancelled)

47. (New) The process of Claims 44 wherein the allolation agent is selected from the group consisting of allyl chloride, allyl bromide, methallyl chloride, allyl acetate, allyl alcohol, and allyl carbonate.

48. (New) The process of Claim 44 wherein the aryl allyl ether is represented by the structure of the following Formula I:

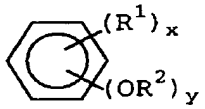
Formula I

$$(R^1)_x\ Ar(OR^2)_y$$

wherein Ar is an aromatic-containing moiety; $R^1$ is a group substituted for a hydrogen atom on the Ar moiety; $R^2$ is a propenyl-containing moiety; x is from 0 to 750; and y is from 1 to 150.

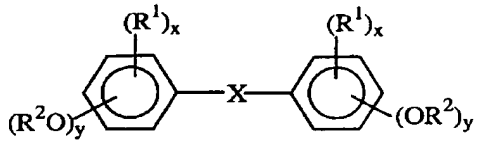
49. (New) The process of Claim 48 wherein the aryl allyl ether is one or more aryl allyl ethers represented by any one or more of the following Formulas II-V:

Formula II



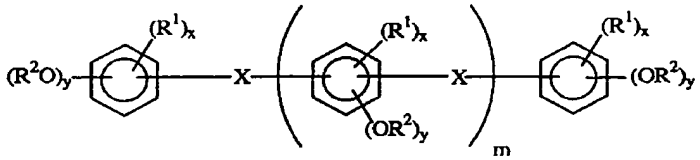
wherein $R^1$ is a group substituted for a hydrogen atom on the phenyl moiety; $R^2$ is a propenyl-containing moiety; x is from 0 to 5; and y is from 1 to 4;

Formula III



wherein $R^1$ is a group substituted for a hydrogen atom on the phenyl moiety; $R^2$ is a propenyl-containing moiety; X is nil, a heteroatom with or without substituents thereon to complete its necessary bonding valence, -C(O)-; -$S(O_2)$-; -C(O)NH-; -P(O)Ar-; an organic aliphatic moiety, with or without heteroatoms, and $-CR^3=CH-$, where $R^3$ is hydrogen or an alkyl group, a cycloaliphatic group or aromatic group; a cycloaliphatic group, with or without heteroatoms; or an aromatic group, with or without heteroatoms; or any combination thereof; partially or fully fluorinated; each x is from 0 to 4, and each x can be the same or different; and each y is from 1 to 4, and each y can be the same or different;

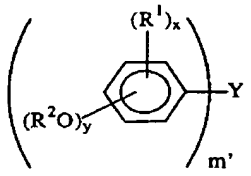
Formula IV



wherein $R^1$ is a group substituted for a hydrogen atom on the phenyl moiety; $R^2$ is a propenyl-containing moiety; X is nil, a heteroatom with or without substituents thereon to complete its necessary bonding valence, -C(O)-; -$S(O_2)$-; -C(O)NH-; -P(O)Ar-; an organic aliphatic moiety, with or without heteroatoms, and $-CR^3=CH-$, where $R^3$ is hydrogen or an alkyl group, a cycloaliphatic group or

aromatic group; a cycloaliphatic group, with or without heteroatoms; or an aromatic group, with or without heteroatoms; or any combination thereof; partially or fully fluorinated; each x is from 0 to 4, and each x can be the same or different; each y is from 1 to 4, and each y can be the same or different; and m is from 0.001 to 10;

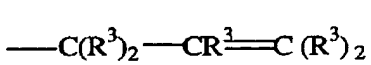
Formula V



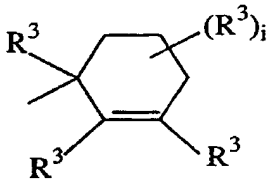

wherein $R^1$ is a group substituted for a hydrogen atom on the phenyl moiety; $R^2$ is a propenyl-containing moiety; Y is an organic aliphatic moiety, with or without heteroatoms such as O, N, S, Si, B or P, or any combination of two or more of the above heteroatoms, wherein the aliphatic moiety has from 1 to 20 carbon atoms; a cycloaliphatic moiety, with or without heteroatoms, having from 3 to 20 carbon atoms; an aromatic moiety, with or without heteroatoms; or any combination thereof, with no more than about 20 carbon atoms; partially or fully fluorinated; an organosiloxane unit with the aryl groups attached to the Si atoms directly or through an organic aliphatic, cycloaliphatic, aromatic group, or any combination thereof, with no more than about 20 carbon atoms; each x is from 0 to 4, and each x can be the same or different; each y is from 1 to 4, and each y can be the same or different; and m' is generally 3 or 4.

50. (New) The process of Claim 49 wherein at least one $R^2$ is a monoalkylene oxide or a polyalkylene oxide terminated with a propenyl-containing moiety.

51. (New) The process of Claim 49 wherein $R^2$ is a propenyl-containing moiety selected from the group consisting of:

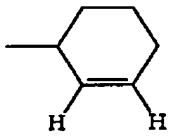


and



wherein each $R^3$ may be the same or different in each occurrence and is hydrogen or an alkyl group, a cycloaliphatic group or aromatic group; and i is from 0 to 6.

52. (New) The process of Claim 5 wherein $R^2$ in Formula II is $-CH_2CH=CH_2$, $-CH_2C(CH_3)=CH_2$ or



.

53. (New) The process of Claim 6 wherein $R^2$ in Formula II is $-CH_2CH=CH_2$.

54. (New) The process of Claim 3 wherein the aryl allyl ether is selected from the group consisting of 2-methyl phenyl allyl ether; 4-methyl phenyl allyl ether; 4-methoxyphenyl allyl ether; 2,6-dimethylphenyl allyl ether; 2,6-diisopropylphenyl allyl ether; 2,6-dibromophenyl allyl ether; 1,2-, 1,3-, 1,4-benzene diallyl ethers; 1,4-, 1,5- and 2,6-naphthalene diallyl ethers; 4,4'-(3,3',5,5'-tetramethyl)bisphenol A diallyl ether; 4,4'-(3,3',5,5'-tetramethyl-2,2',6,6'-tetrabromo)bisphenol A diallyl ether; 4,4'-(3,3',5,5'-tetramethyl)bisphenol F diallyl ether; 4,4'-(3,3'5,5'-tetramethyl)biphenol diallyl ether; 4,4'-biphenol diallyl ether; 4,4'-(3,3',5,5'-tetramethyl)biphenol diallyl ether; 4,4'-(3,3'5,5'-tetramethyl-2,2',6,6'-tetrabromobiphenol)diallyl ether; 4,4'-bisphenol F diallyl ether; 4,4'-bisphenol sulfone diallyl ether; 2,2'-bis (3,5-dibromo-4-hydroxy phenyl)isopropylidene diallyl ether; 4,4'-bisphenol A diallyl ether; 4,4'-bisphenol K diallyl ether; 9,9-bis(4-hydroxyphenyl)fluorene diallyl ether; 4,4'-dihydroxy-α-methylstilbene diallyl ether; 1,3-bis(4-hydroxyphenyl)adamantane diallyl

ether; phenol-formaldehyde novolac allyl ether (functionality >2); o-cresol-formaldehyde novolac allyl ether (functionality >2); phenol-dicyclopentadienyl novolac allyl ether (functionality >2); naphthol-formaldehyde novolac allyl ether (functionality >2); trisphenylol methane triallyl ether; tris(3,5-dimethyl-4-hydroxyphenyl)methane triallyl ether; 1,1,2,2-tetraphenylol ethane tetraallyl ether; or mixture thereof.

55. (New) The process of Claim 44 wherein the α-dihydroxy derivative of a phenol or mixture of phenols is represented by the structure of the following Formula XI:

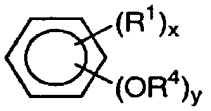
Formula XI

$$(R^1)_xAr(OR^4)_y$$

wherein Ar is an aromatic-containing moiety; $R^1$ is a group substituted for a hydrogen atom on the Ar moiety; $R^4$ is α-2,3-dihydroxy propyl-containing moiety; x is from 0 to 750; and y is from 1 to 150.

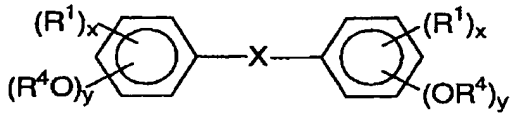
56. (New) The process of Claim 55 wherein the α-dihydroxy derivative of a phenol or mixture of phenols is represented by any one or more of the following Formulas XII-XV:

Formula XII



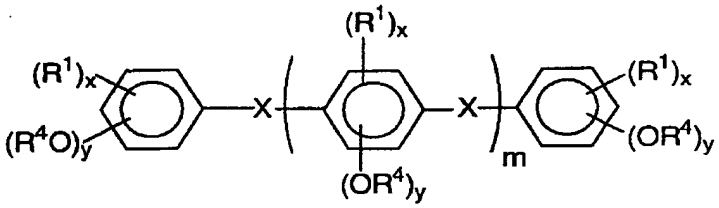

wherein $R^1$ is a group substituted for a hydrogen atom on the phenyl moiety; $R^4$ is an α-dihydroxy propyl-containing moiety; x is from 0 to 5; and y is from 1 to 4;

Formula XIII



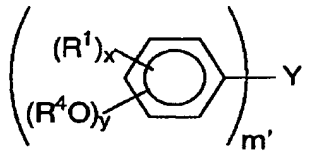
wherein $R^1$ is a group substituted for a hydrogen atom on the phenyl moiety; $R^4$ is an α-dihydroxy propyl-containing moiety; X is nil, a heteroatom with or without substituents thereon to complete its necessary bonding valence, -C(O)-; -$S(O_2)$-; -C(O)NH-; -P(O)Ar-; an organic aliphatic moiety, with or without heteroatoms, and —$CR^3$=CH—, where $R^3$ is hydrogen or an alkyl group, a cycloaliphatic group or aromatic group; a cycloaliphatic group, with or without heteroatoms; or an aromatic group, with or without heteroatoms; or any combination thereof; partially or fully fluorinated; each x is from 0 to 4, and each x can be the same or different; and each y is from 1 to 4, and each y can be the same or different;

Formula XIV



wherein $R^1$ is a group substituted for a hydrogen atom on the phenyl moiety; $R^4$ is an α-dihydroxy propyl-containing moiety; X is nil, a heteroatom with or without substituents thereon to complete its necessary bonding valence, -C(O)-; -$S(O_2)$-; -C(O)NH-; -P(O)Ar-; an organic aliphatic moiety, with or without heteroatoms, and —$CR^3$=CH—, where $R^3$ is hydrogen or an alkyl group, a cycloaliphatic group or aromatic group; a cycloaliphatic group, with or without heteroatoms; or an aromatic group, with or without heteroatoms; or any combination thereof; partially or fully fluorinated; x is from 0 to 4, and each x can be the same or different; each y is from 1 to 4, and each y can be the same or different; and m is from 0.001 to 10;

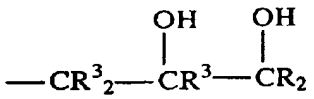
Formula XV



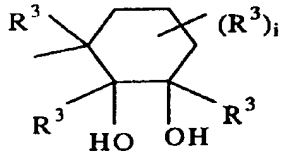
wherein $R^1$ is a group substituted for a hydrogen atom on the phenyl moiety; $R^4$ is an α-dihydroxy propyl-containing moiety; Y is an organic aliphatic moiety, with or without heteroatoms such as O, N, S, Si, B or P, or any combination of two or more of the above heteroatoms, wherein the aliphatic moiety has from 1 to 20 carbon atoms; a cycloaliphatic moiety, with or without heteroatoms, having from 3 to 20 carbon atoms; an aromatic moiety, with or without heteroatoms; or any combination thereof, with no more than about 20 carbon atoms; partially or fully fluorinated; an organosiloxane unit with the aryl groups attached to the Si atoms directly or through an organic aliphatic, cycloaliphatic, aromatic group, or any combination thereof, with no more than about 20 carbon atoms; each x is from 0 to 4, and each x can be the same or different; each y is from 1 to 4, and each y can be the same or different; and m' is generally 3 or 4.

57. (New) The process of Claim 56 wherein at least one $R^4$ is a monoalkylene oxide or a polyalkylene oxide terminated with a 2,3-dihydroxy propyl-containing moiety.

58. (New) The process of Claim 56 wherein $R^4$ is a α-dihydroxy propyl-containing moiety selected from the group consisting of:

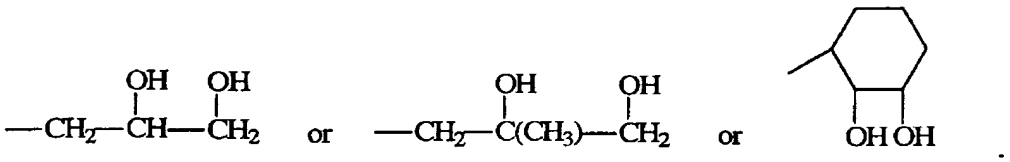


or

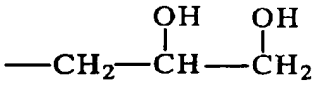


wherein $R^3$ is the same or different in each occurrence and is hydrogen or an alkyl group, a cycloaliphatic group or aromatic group; and i is from 0 to 6.

59. (New) The process of Claim 58 wherein $R^4$ is selected from the group consisting of



60. (New) The process of Claim 59 wherein $R^4$ is



61. (New) The process of Claim 56 wherein α-dihydroxy derivative is selected from the group comprising (2,3-α-dihydroxypropyl)ether of 2-methylphenol; (2,3-α-dihydroxypropyl)ether of 4-methylphenol; (2,3-α-dihydroxypropyl)ether of 4-methoxyphenol; (2,3-α-dihydroxypropyl)ether of 2,6-dimethylphenol; (2,3-α-dihydroxypropyl)ether of 2,6-diisopropylphenol; (2,3-α-dihydroxypropyl)ether of 2,6-dibromophenol; bis(2,3-α-dihydroxypropyl)ether of 1,2-, 1,3- and 1,4-dihydroxybenzene; bis(2,3-α-dihydroxypropyl)ether of 1,4-, 1,5- and 2,6-dihydroxynaphthalene; bis(2,3-α-dihydroxypropyl)ether of 4,4'-(3,3',5,5'-tetramethyl)bisphenol A; bis(2,3-α-dihydroxypropyl)ether of 4,4'-(3,3',5,5'-tetramethyl-2,2',6,6'-tetrabromo)bisphenol A; bis(2,3-α-dihydroxypropyl)ether of 4,4'-(3,3',5,5'-tetramethyl)bisphenol F; bis(2,3-α-dihydroxypropyl)ether of 4,4'-(3,3'5,5'-tetramethyl)biphenol; bis(2,3-α-dihydroxypropyl)ether of 4,4'-biphenol; bis(2,3-α-dihydroxypropyl)ether of 4,4'-(3,3'5,5'-tetramethyl-2,2',6,6'-tetrabromo)biphenol; bis(2,3-α-dihydroxypropyl)ether of 4,4'-bisphenol F; bis(2,3-α-dihydroxypropyl)ether of 4,4'-bisphenol sulfone; bis(2,3-α-dihydroxypropyl)ether of 2,2'-bis(3,5-dibromo-4-hydroxyphenyl)isopropylidene; bis(2,3-α-dihydroxypropyl)ether of 4,4'-bisphenol A; bis(2,3-α-dihydroxypropyl)ether of 4,4'-bisphenol K; bis(2,3-α-dihydroxypropyl)ether of 9,9-bis(4-hydroxyphenyl)fluorene;

bis(2,3-α-dihydroxypropyl)ether of 4,4'-dihydroxy-α-methylstilbene; bis(2,3-α-dihydroxypropyl)ether of 1,3-bis(4-hydroxyphenyl)adamantane; (2,3-α-dihydroxypropyl)ether of phenol-formaldehyde novolac (functionality >2); (2,3-α-dihydroxypropyl)ether of o-cresol-formaldehyde novolac (functionality >2); (2,3-α-dihydroxypropyl)ether of phenol-dicyclopentadienyl novolac (functionality >2); (2,3-α-dihydroxypropyl)ether of naphthol-formaldehyde novolac (functionality >2); tris(2,3-α-dihydroxypropyl)ether of trisphenylol methane; tris(2,3-α-dihydroxypropyl)ether of tris(3,5-dimethyl-4-hydroxyphenyl)methane; tetra(2,3-α-dihydroxypropyl)ether of 1,1,2,2-tetraphenylol ethane; and mixtures thereof.

62. (New) The process of Claim 44 wherein the aryl glycidyl ether epoxy resin compound of a phenol or mixture of phenols is represented by the structure of the following Formula XVI:

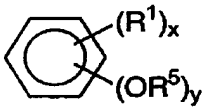
Formula XVI

$$(R^1)_xAr(OR^5)_y$$

wherein Ar is an aromatic-containing moiety; $R^1$ is a group substituted for a hydrogen atom on the Ar moiety; $R^5$ is glycidyl-containing moiety; x is from 0 to 750; and y is from 1 to 150.

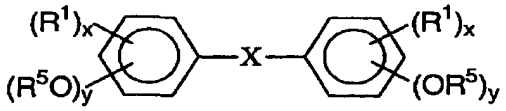
63. (New) The process of Claim 62 wherein the aryl glycidyl ether epoxy resin compound is one or more compounds represented by any one or more of the following Formulas XVII-XX.

Formula XVII



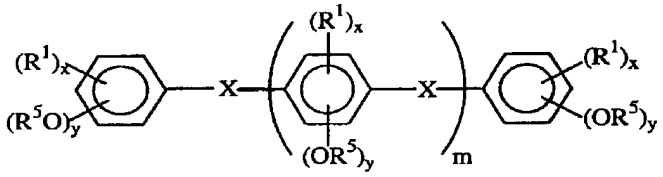

wherein $R^1$ is a group substituted for a hydrogen atom on the phenyl moiety; $R^5$ is glycidyl-containing moiety; x is from 0 to 5; and y is from 1 to 4;

Formula XVIII



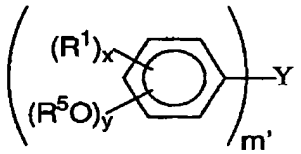
wherein $R^1$ is a group substituted for a hydrogen atom on the phenyl moiety; $R^5$ is glycidyl-containing moiety; X is nil, a heteroatom with or without substituents thereon to complete its necessary bonding valence, -C(O)-; -S(O$_2$)-; -C(O)NH-; -P(O)Ar-; an organic aliphatic moiety, with or without heteroatoms, and —$CR^3$=CH—, where $R^3$ is hydrogen or an alkyl group, a cycloaliphatic group or aromatic group; a cycloaliphatic group, with or without heteroatoms; or an aromatic group, with or without heteroatoms; or any combination thereof; partially or fully fluorinated; each x is from 0 to 4, and each x can be the same or different; and each y is from 1 to 4, and each y can be the same or different;

Formula XIX



wherein $R^1$ is a group substituted for a hydrogen atom on the phenyl moiety; $R^5$ is glycidyl-containing moiety; X is nil, a heteroatom with or without substituents thereon to complete its necessary bonding valence, -C(O)-; -S(O$_2$)-; -C(O)NH-; -P(O)Ar-; an organic aliphatic moiety, with or without heteroatoms, and —$CR^3$=CH—, where $R^3$ is hydrogen or an alkyl group, a cycloaliphatic group or aromatic group; a cycloaliphatic group, with or without heteroatoms; or an aromatic group, with or without heteroatoms; or any combination thereof; partially or fully fluorinated; x is from 0 to 4, and each x can be the same or different; each y is from 1 to 4, and each y can be the same or different; and m is from 0.001 to 10;

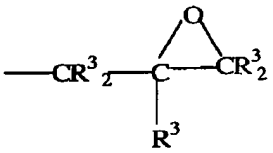
Formula XX



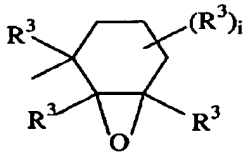
wherein $R^1$ is a group substituted for a hydrogen atom on the phenyl moiety; $R^5$ is glycidyl-containing moiety; Y is an organic aliphatic moiety, with or without heteroatoms such as O, N, S, Si, B or P, or any combination of two or more of the above heteroatoms, wherein the aliphatic moiety has from 1 to 20 carbon atoms; a cycloaliphatic moiety, with or without heteroatoms, having from 3 to 20 carbon atoms; an aromatic moiety, with or without heteroatoms; or any combination thereof, with no more than about 20 carbon atoms; partially or fully fluorinated; an organosiloxane unit with the aryl groups attached to the Si atoms directly or through an organic aliphatic, cycloaliphatic, aromatic group, or any combination thereof, with no more than about 20 carbon atoms; each x is from 0 to 4, and each x can be the same or different; each y is from 1 to 4, and each y can be the same or different; and m' is generally 3 or 4.

64. (New) The process of Claim 63 wherein at least one $R^5$ is a monoalkylene oxide or a polyalkylene oxide terminated with a propenyl-containing moiety.

65. (New) The process of Claim 63 wherein $R^5$ is a glycidyl-containing moiety preferably selected from the group consisting of:

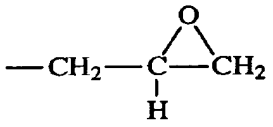
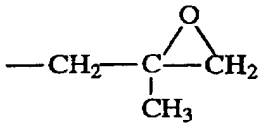
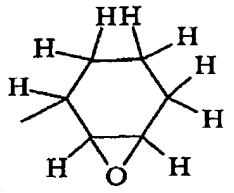


or

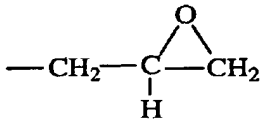


wherein each $R^3$ may be the same or different in each occurrence and is hydrogen or an alkyl group, a cycloaliphatic group or aromatic group; and i is from 0 to 6.

66. (New) The process of Claim 65 wherein $R^5$ is


or

or

.

67. (New) The process of Claims 66 wherein $R^5$ is


.

68. (New) The process of Claim 63 wherein the aryl glycidyl ether epoxy resin compound of a phenol or mixture of phenols is selected from the group consisting of 2-methylphenol glycidyl ether; 4-methylphenol glycidyl ether; 4-methoxyphenol glycidyl ether; 2,6-dimethylphenol glycidyl ether; 2,6-diisopropylphenol glycidyl ether; 2,6-dibromophenol glycidyl ether; 1,2-, 1,3- and 1,4-dihydroxybenzene diglycidyl ethers; 1,4-, 1,5- and 2,6-dihydroxynaphthalene diglycidyl ethers; 4,4'-(3,3',5,5'-tetramethyl)bisphenol A diglycidyl ether; 4,4'-(3,3',5,5'-tetramethyl-2,2',6,6'-tetrabromo)bisphenol A diglycidyl ether; 4,4'-(3,3',5,5'-tetramethyl)bisphenol F diglycidyl ether; 4,4'-(3,3'5,5'-tetramethyl)biphenol diglycidyl ether; 4,4'-biphenol diglycidyl ether; 4,4'-(3,3'5,5'-tetramethyl-2,2',6,6'-tetrabromo)biphenol diglycidyl ether; 4,4'-bisphenol F diglycidyl ether; 4,4'-bisphenol sulfone diglycidyl ether; 4,4'-(3,3',5,5'-tetrabromo)bisphenol A diglycidyl ether; 4,4'-bisphenol A diglycidyl ether; 4,4'-bisphenol K diglycidyl ether; 9,9-bis(4-hydroxyphenyl)fluorene diglycidyl ether; 4,4'-dihydroxy-α-methylstilbene diglycidyl ether; 1,3-bis(4-hydroxyphenyl)adamantane diglycidyl ether; phenol-formaldehyde novolac glycidyl ether (functionality >2); o-cresol-formaldehyde novolac glycidyl ether (functionality >2); phenol-dicyclopentadienyl novolac glycidyl ether (functionality >2); naphthol-formaldehyde novolac glycidyl ether (functionality >2); trisphenylol methane triglycidyl ether;

tris(3,5-dimethyl-4-hydroxyphenyl)methane triglycidyl ether; 1,1,2,2-tetraphenylol ethane tetraglycidyl ether; or mixtures thereof.

69. (New) The process of Claim 44, wherein step (b), converting an aryl allyl ether of a phenol or mixture of phenols to an α-dihydroxy derivative of a phenol or mixture of phenols, is carried out in the presence of an oxidant.

70. (New) The process of Claim 69 wherein the oxidant is an aromatic or aliphatic organic peracid, an organic peroxyimidic acid, an organic N-oxide, a selenic peracid, a persulfates or a dioxirane.

71. (New) The process of Claim 69 wherein the oxidant is an oxidizing metal salt.

72. (New) The process of Claim 69 wherein the oxidizing metal salt is selected from the group comprising oxides of osmium, $K_3Fe(CN)_6$, or $KIO_4$.

73. (New) The process of Claim 69 wherein the ratio of the oxidant used for dihydroxylation of the aryl allyl ether is in the range of from about 0.6 mole to about 20 moles of oxidant to 1 equivalent of aryl allyl ether.

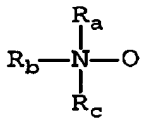
74. (New) The process of Claim 44, wherein step (b), converting an aryl allyl ether of a phenol or mixture of phenols to an α-dihydroxy derivative of a phenol or mixture of phenols, is carried out in the presence of an oxidant and a catalyst.

75. (New) The process of Claim 75 wherein the oxidant is air, oxygen, oxygen-gas(es) mixture(s), hydrogen peroxide, a tertiary organic amine N-oxide, an organic hydroperoxide, a periodate salt, a hypochlorite salt, a persulfate salt, or an iron (III) salt.

76. (New) The process of Claim 74 wherein the oxygen in the dihydroxylation reaction is present as pure oxygen or the oxygen is present as a mixture of gases.

77. (New) The process of Claim 76 wherein oxygen is present in the dihydroxylation reaction as a mixture of oxygen and nitrogen with oxygen being from about 1% to about 100% on a volume basis.

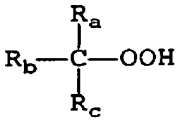
78. (New) The process of Claim 74 wherein the tertiary organic amine N-oxide has the general structure



wherein $R_a$, $R_b$, and $R_c$ have from 1 to 12 carbon atoms; and wherein $R_a$, $R_b$, and $R_c$ are the same or different.

79. (New) The process of Claim 78 wherein the organic amine N-oxides is selected from the group consisting of trimethylamine N-oxide, triethylamine N-oxide, N-methyl morpholine N-oxide, pyridine N-oxide, or mixtures thereof.

80. (New) The process of Claim 75 wherein the organic hydroperoxide has the general structure



wherein $R_a$, $R_b$, and $R_c$ are each individually selected from the group consisting of hydrogen; an alkyl group; a cycloaliphatic group; an aromatic group; or any combination thereof, have from 1 to 12 carbon atoms; and $R_a$, $R_b$, and $R_c$ are the same or different.

81. (New) The process of Claim 80 wherein the organic hydroperoxide is selected from the group consisting of tert-butyl hydroperoxide; tert-amyl hydroperoxide; cumene hydroperoxide; ethyl benzene hydroperoxide; cyclohexane hydroperoxide; methyl cyclohexane hydroperoxide; pinane hydroperoxide;

tetrahydronaphthalene hydroperoxide; isobutyl benzene hydroperoxide; isopropyl hydroperoxide; and ethyl naphthalene hydroperoxide; or mixtures thereof.

82. (New) The process of Claim 74 wherein the ratio of the oxidant used for catalytic dihydroxylation of the aryl allyl ether is in the range of from about 0.6 mole to 20 moles of oxidant to 1 equivalent of aryl allyl ether.

83. (New) The process of Claim 44 wherein the catalyst is a transition metal-containing catalyst or a Group VIB element-containing catalyst.

84. (New) The process of Claim 83 wherein the transition metal is selected from the group consisting of Group IVA, Group VA, Group VIA, Group VIIA, and Group VIII transition metals.

85. (New) The process of Claim 84 wherein the transition metal or Group VIB element comprises a metal or element selected from the group comprising Os, Mn, Re, Ru, W, Cr, Mo, V, Ti, Se, Bi, Ni, Cu, Sb, Fe, Tl, Pb, Rh,and Te.

86. (New) The process of Claim 85 wherein the transition metal is selected from the group consisting of Os, Mn, or Ru.

87. (New) The process of Claim 83 wherein the transition metal-containing catalyst or Group VIB element-containing catalyst is useful as a $\alpha$-dihydroxylation catalyst is soluble and is a homogeneous catalyst.

88. (New) The process of Claim 83 wherein the transition metal-containing catalyst or and Group VIB element-containing catalyst useful as a $\alpha$-dihydroxylation catalyst is bound covalently or ionically to a solid support and is a heterogenous catalyst.

89. (New) The process of Claim 87 wherein the molar ratio of transition metal-containing catalyst or Group VIB element-containing catalyst to aryl allyl ether present in the reaction mixture is from about $1X10^{-6}$ to about 1 mole of catalyst per 1 mole of aryl allyl ether.

90. (New) The process of Claim 88 wherein the total weight of the metal or element in the catalyst to the total weight of the solid support material is in the range of from about $1X10^{-6}$ parts to about 1 part of metal or element per 1 part of solid support.

91. (New) The process of Claim 90 wherein the weight ratio of heterogeneous catalyst to substrate aryl allyl ether is in the range of from about 100 parts to about $10^{-3}$ parts of heterogeneous catalyst to 1 part of aryl allyl ether.

92. (New) The process of Claim 44 wherein an additive, a co-catalyst or a co-oxidant is used together with the oxidant and catalyst.

93. (New) The process of Claim 92 wherein the additive is a pH regulator to control pH between about 7.5 to about 13.

94. (New) The process of Claim 93 wherein the additive is a tertiary amine or a diamine.

95. (New) The process of Claim 92 wherein the co-catalyst is a hydrolysis aid.

96. (New) The process of Claim 95 wherein the co-catalyst hydrolysis aid is methanesufonamide or a salt of an alkyl sulfonamide or an alkyl carboxylate.

97. (New) The process of Claim 92 wherein the co- oxidant is a salt or a complex of Cu I or Cu II, V, Nb, Ta, Ti, Zr, Hf, W, or Mo.

98. (New) The process of Claim 92 wherein the co-oxidant is a naturally occurring flavone or a synthetic analog thereof.

99. (New) The process of Claim 92 wherein the additive, co-catalyst, or co-oxidant is used in the range of from about $1X10^{-3}$ mole to about 0.20 mole of additive, co-catalyst, or co-oxidant per 1 equivalent of allyl ether group.

100. (New) The process of Claim 44, wherein in step (b) of converting an aryl allyl ether of a phenol or mixture of phenols to an α-dihydroxy derivative of a

phenol or mixture of phenols, the temperature of the dihydroxylation reaction is from about -20 °C to about 150 °C.

101. (New) The process of Claim 44, wherein in step (b) of converting an aryl allyl ether of a phenol or mixture of phenols to an α-dihydroxy derivative of a phenol or mixture of phenols, the pressure is sub-atmospheric, atmospheric, or super-atmospheric.

102. (New) The process of Claim 44, wherein in step (b) of converting an aryl allyl ether of a phenol or mixture of phenols to an α-dihydroxy derivative of a phenol or mixture of phenols, the dihydroxylation reaction is done in the presence of a solvent.

103. (New) The process of Claim 102 wherein the solvent is an aliphatic, cycloaliphatic or aromatic hydrocarbon, ester, ether, alcohol and nitrile solvent; partially or fully halogenated aliphatic, cycloaliphatic or aromatic hydrocarbon, ester, ether, alcohol or nitrile solvent; ketone; water; and combinations thereof.

104. (New) The process of Claim 102 wherein the solvent is employed in an amount of from about 0 parts by weight to about 100 parts by weight of solvent per one part of substrate reactant aryl allyl ether.